

## Claims

1. A solid electrolyte comprising an inorganic substance comprising a lithium ion conductive crystalline and being substantially free of an organic substance and an electrolytic solution.
2. A solid electrolyte as defined in claim 1 wherein the inorganic substance comprising a lithium ion conductive crystalline is substantially free of a pore or a crystal grain boundary which obstructs ion conduction.
3. A solid electrolyte as defined in claim 1 wherein the inorganic substance comprising a lithium ion conductive crystalline is lithium ion conductive glass-ceramics.
4. A solid electrolyte as defined in claim 1 comprising an inorganic substance powder comprising a lithium ion conductive crystalline and an inorganic substance comprising Li.
5. A solid electrolyte as defined in claim 4 wherein the inorganic substance powder comprising a lithium ion conductive crystalline has ion conductivity of  $10^{-4} \text{ SCm}^{-1}$  or over, has an average particle diameter of  $9 \mu \text{m}$  or below, and is contained in the solid electrolyte in an amount within a range from 50 mass% to 95 mass%.
6. A solid electrolyte as defined in claim 3 wherein the ion conductive glass-ceramics are in the form of a thin plate.
7. A solid electrolyte as defined in claim 6 wherein the lithium ion conductive glass-ceramics have a thickness within a range from 15  $\mu \text{m}$  to 200  $\mu \text{m}$ .
8. A solid electrolyte as defined in claim 1 having ion conductivity which is  $10^{-5} \text{ SCm}^{-1}$  or over.

9. A solid electrolyte as defined in claim 1 wherein the anorganic substance comprising a lithium ion conductive crystalline has a predominant crystal phase of  $\text{Li}_{i+x}\text{Al}_x\text{Ti}_{2-x}\text{Si}_y\text{P}_{3-y}\text{O}_{i+2}$  where  $0 \leq x \leq 1$  and  $0 \leq y \leq 1$ .

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10. A solid electrolyte as defined in claim 1 wherein the inorganic substance comprising a lithium ion conductive crystalline comprises, in mol %;

	$\text{Li}_2\text{O}$	12 - 18%
10	$\text{Al}_2\text{O}_3 + \text{Ga}_2\text{O}_3$	5 - 10%
	$\text{TiO}_2 + \text{GeO}_2$	35 - 45%
	$\text{SiO}_2$	1 - 10% and
	$\text{P}_2\text{O}_5$	30 - 40%.

15 11. A solid electrolyte as defined in claim 1 wherein the inorganic substance comprising a lithium ion conductive crystalline comprises, in mass %;

	$\text{Li}_2\text{O}$	3 - 10%
20	$\text{Al}_2\text{O}_3 + \text{Ga}_2\text{O}_3$	5 - 20%
	$\text{TiO}_2 + \text{GeO}_2$	25 - 40%
	$\text{SiO}_2$	0.5 - 8% and
	$\text{P}_2\text{O}_5$	40 - 55%.

25 12. A lithium ion secondary battery comprising a solid electrolyte as defined in any of claims 1 —11.

30 13. A lithium ion secondary battery as defined in claim 12 comprising an inorganic substance comprising a lithium ion conductive crystalline in a positive electrode and/or a negative electrode.

35 14. A lithium ion secondary battery as defined in claim 13 wherein the inorganic substance comprising a lithium ion conductive crystalline contained in the positive electrode and/or the negative electrode is substantially free of a pore or a crystal grain boundary which obstructs ion conduction.

15. A lithium ion secondary battery as defined in claim 13 wherein the inorganic substance comprising a lithium ion conductive crystalline contained in the positive electrode and/or the negative electrode is a lithium ion conductive glass-ceramics.

16. A lithium ion secondary battery as defined in claim 13 wherein an average particle diameter of the inorganic substance comprising a lithium ion conductive crystalline contained in the positive electrode and/or the negative electrode is 1/5 or below of an average particle diameter of an active material of the positive electrode and/or the negative electrode comprising an inorganic substance comprising a lithium ion conductive crystalline.

17. A lithium ion secondary battery as defined in claim 13 wherein an amount of the inorganic substance comprising a lithium ion conductive crystalline contained in the positive electrode and/or the negative electrode is 2—35 mass % of an active material of the positive electrode and/or the negative electrode.

18. A lithium ion secondary battery as defined in claim 13 wherein the inorganic substance comprising a lithium ion conductive crystalline contained in the positive electrode and/or the negative electrode comprises, in mol %:

25	$\text{Li}_2\text{O}$	12 - 18%
	$\text{Al}_2\text{O}_3 + \text{Ga}_2\text{O}_3$	5 - 10%
	$\text{TiO}_2 + \text{GeO}_2$	35 - 45%
	$\text{SiO}_2$	1 - 10% and
	$\text{P}_2\text{O}_5$	30 - 40%.

19. A lithium ion secondary battery as defined in claim 13 wherein the inorganic substance comprising a lithium ion conductive crystalline contained in the positive electrode and/or the negative electrode comprises, in mass %:

30	$\text{Li}_2\text{O}$	3 - 10%
	$\text{Al}_2\text{O}_3 + \text{Ga}_2\text{O}_3$	5 - 20%

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TiO <sub>2</sub> + GeO <sub>2</sub>	25 - 40%
SiO <sub>2</sub>	0.5 - 8% and
P <sub>2</sub> O <sub>5</sub>	40 - 55%.

5 20. A lithium ion secondary battery as defined in claim 13 wherein  
the inorganic substance comprising a lithium ion conductive  
crystalline contained in the positive electrode and/or the negative  
electrode has a predominant crystal phase of  
Lii<sup>+</sup><sub>x+y</sub>Al<sub>x</sub>Ti<sub>2-y</sub>Si<sub>y</sub>P<sub>3-y</sub>O<sub>12</sub> where 0≤ x≤ 1 and 0≤ y≤ 1.

10 21. A lithium ion secondary battery as defined in any of claims 13 —  
17 which comprises, in the positive electrode and/or the negative  
electrode, the same inorganic substance as the inorganic substance  
comprising a lithium ion conductive crystalline contained in the  
15 solid electrolyte.